4:30

INTRAVASCULAR ULTRASOUND ASSESSMENT OF PLAQUE RESPONSES TO PTCA HELPS TO EXPLAIN ANGIOGRAPHIC FINDINGS

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Atheroma (A) composition can be characterized by intravascular ultrasound (IVUS) and may be an important determinant of PTCA results. We used IVUS in 23 pts (6 LAD, 2 LCX, 8 RCA, and 7 vein grafts) immediately after PTCA to assess mechanisms of success and failure. A motor driven single crystal catheter (20 MHz) rotated in a 4.9F sheath was used for imaging. Angiographic improvement after PTCA (% diameter stenosis reduced from 90±9 to 18±7) was associated with significant residual A at the PTCA site (average A area 3.9 mm2) indicating that geometric distortion of vessel wall contours caused increased lumen area. Compared with angiography, IVUS was more sensitive in detecting PTCA-induced dissections and fissures (7 vs 15, p<.01). PTCA site A were classified by IVUS as "hard" (highly echoic components suggesting fibrous tissue and/or calcification) or "soft" (mildly echoic, suggesting lipid, cellular, or thrombotic elements). Angiographic responses were associated with the following IVUS image: For hard A (n=14): 1) angiographic success = discrete dissection planes often extending into the media; 2) angiographic failure = non-compressible lesions (usually calcified) without dissection; 3) abrupt closure = more extensive (at times circumferential) dissection with flow-limiting flaps. For soft A(n=9): 1) angiographic success = multiple superficial fissures or fractures of the lumen surface; 2) angiographic failure = no disruption of the lumen surface with recoil of lumen area; 3) abrupt closure = thrombus formation with probable plaque rupture. Thus, IVUS imaging provides important pathoanatomic insights which may help to explain PTCA success and failure.

5:00

THE PROGNOSTIC IMPORTANCE OF QUANTITATIVE ANALYSIS OF THE CINEANGIOGRAM: A CASS REGISTRY ANGIOGRAPHIC STUDY

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Trials assessing new therapy often use quantitative measures of regional wall motion (RWM) and coronary artery stenosis (%DS) to determine efficacy but the prognostic value of these relative to the ejection fraction (EF) is not clear. 277 patients from the Montreal Heart Institute out of 3566 from the CASS Registry with at least 10 years of follow-up were randomly selected and their baseline cines quantitated: EF (area length), quantitative coronary arteriography (%DS), RWM (centerline method) and regional shape analysis (Quantitative Regional Curvature Analysis method). Major cardiac events were unstable angina (n=46), myocardial infarction (n=42), congestive heart failure (n=20), ventricular tachycardia (n=2), other arrhythmias (n=8), syncope (n=3), cardiogenic shock (n=5), sudden death (n=18), bypass surgery (n=40), and angioplasty (n=1). 103 patients had no events. Proportional hazards stepwise regression demonstrated absence of any prognostic value of RWM measurements. Lethal cardiac events, sudden death, and development of congestive heart failure were most strongly related to EF and %DS. The occurrence of any cardiac event was most closely related to the %DS in the LAD, the shape of the inferior wall and overall EF. Both MI and lethal MI were best predicted by %DS of the left main, followed by %DS of the LAD or Cx. Development of unstable angina was best predicted by %DS of the LAD and the shape of the inferior wall. Thus, EF, %DS and regional ventricular shape are of greater prognostic importance than RWM.

4:45

HEPARIN INDUCED EXTRACORPOREAL LDL-PRECIPITATION (HELP) PROMOTES REGRESSION (REG) IN PATIENTS WITH FAMILIAL HYPERCHOLESTEROLEMIA II (FH)

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Marked reduction of moderately elevated LDL-Cholesterol (LDL-C) can induce regression (REG) of coronary artery disease (CAD).
To analyse whether REG can also be achieved in Pts with severely elevated LDL-C we treated 5 Pts with diffuse CAD for 2 years by weekly HELP. Prospectively obtained coronary angiograms before and after 2 years of HELP were analyzed using Quantitative Angiography (QA) and Visual Assessment (Vs.A) by "blinded" angiographers. The mean level of LDL-C was reduced from 305 mg/dl to 120 mg/dl (-60%). HDL-C increased from 40 to 45 mg/dl (+ 12%) p<0.01.
A total of 2 x 82 identical angiographic segments could be evaluated in both cine films by QA, 2 x 85 segments by visual assessment.
Progression (>6% increase of stenosis) by QA was observed in 9 segments, REG (>6% decrease of stenosis) in 16 segments and no change in 57 segments; p= 0.1. The mean luminal diameter stenosis evaluated by QA decreased by 8.2%; p= 0.15. By Vs.A progression to a higher AHA grade was seen in 3 segments, regression in 7 segments and no change in the remainder. The mean diameter stenosis by Vs.A decreased by 0.15 AHA grades; p= 0.1.
Conclusion: LDL-C reduction by HELP can induce regression of CAD in patients with FH IIa and advanced disease. The combination of HELP treatment with HMG CoA reductase inhibitors will further reduce LDL-C levels and may enhance regression.

5:15

DETERMINATION OF CORONARY ARTERY BLOOD FLOW SHEAR RATES BASED ON DOPPLER CATHETER RECORDINGS

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Abnormal arterial shear rates are thought to play a major role in thrombosis, atherosclerosis and restenosis following angioplasty. Currently, however, there is no direct method to measure local shear rates in the clinical setting. We hypothesized that the peak frequency shift (μ_p) of spectrally-analyzed Doppler catheter recordings would correlate with maximum shear rate. To test this hypothesis, we constructed an axisymmetric scaled-up model of coronary flow. We used an optically clear cylindrical test section through which accurate laser-Doppler velocimeter (LDV) measurements could be performed in addition to Doppler catheter recordings. Various shear rates were produced by serially introducing stenoses of 20, 40 and 60% cross-sectional area. Additionally, Reynolds numbers of 200, 300 and 400 were tested, spanning the physiologic range for the coronary circulation. LDV data were collected at multiple positions proximal to, within, and distal to each stenosis at the different Reynolds numbers. Fifth order polynomials were fitted to the LDV data to produce velocity profiles and the maximum shear rate (du/dr_{max}) was calculated for each profile. Subsequently, a custom designed Doppler catheter with guidewire was used to make velocity recordings at each location and Reynolds number previously studied for each stenosis.
Results: There was a close correlation of μ_p and du/dr_{max}:

$$du/dr_{max} = 0.070\mu_p + 8.1 \text{ cm/sec·cm} \quad (r = 0.95).$$

Conclusions: This study suggests that the peak frequency shift as determined by spectral analysis of Doppler catheter recordings can be used to derive the maximum shear rate occurring within the sample volume. This measurement may provide the basis for clinical studies of the role of local shear states in thrombosis, atherosclerosis and restenosis following angioplasty.